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## CORN CANE.\*

BY F. L. STEWART, MURRYSVILLE, PA.

MUCH attention was given to the physiological affinities of maize to discover, if possible, whether in the case of any other of the solid-stemmed grasses with which it naturally ranks, a similar correlation exists between seed development and the accumulation of reserve materials in the culm, with cane sugar as the principal ultimate product.

In this connection, it became a point of especial interest to determine what the deportment of sugar cane and sorghum would be under like conditions, and accordingly the investigation was extended to them, along the same lines.

It was soon found that a comparatively new field had been entered upon and that no progress could be made without constant appeal to the microscope and approved methods of chemical analysis for the correct determination of many important questions requiring solution. Thus, some safeguard was established to prevent false analogies from being followed and false conclusions reached, such as have marked and marred the whole rationale of treatment, both of the beet and of sorghum, in the attempt to make sugar manufacture from them practicable in this country.

It was found to be the fact, uniformly, that from the time the sugar first shows itself in the cell sap, during the early growth of maize, until the grain begins to harden, it steadily increases. But what is most remarkable is that it then suddenly diminishes and disappears, leaving behind it scarce a trace of its former presence. Other allied plants, such as sorghum, up to a certain period of growth, manifest the same characteristics, but beyond that the resemblance ends. Sorghum does not reach its full saccharine strength until its seed is dead ripe. Maize, on the contrary, if its grain be allowed to pass into that condition, parts with its sugar utterly, but if the offered alternative be taken and the ear be removed promptly at the critical period, all the vital energies of the plant become at once directed to the special work of storing up highly organized food materials in the cells of the stalk. Instead of dying, off hand, as it does in the other case, the plant *lives on*, and without a break the constructive forces go on converting the simpler into the more complex reserve materials. The stalk is their storehouse, and, under the new conditions imposed, that part of the plant passes through a supplementary stage of

development. Its principal function then is to accumulate sugar.

It would be out of place, in a brief sketch, to particularize the changes then occurring, further than to say that the other carbohydrates, generally, give place to sugar. There is also a sensible increase of the protein substances keeping pace with the increase of the sugar.

It is then a process of *juice ripening*, borrowing the term from an analogous process which is carried on in the maturing joints of the sugar cane. This led to a closer comparison of the latter with Indian corn when in this anomalous condition. Living ribbon cane from Louisiana, received here fully matured and in perfectly good condition, and young joints at hand growing under glass, furnished ready means of comparing them closely under all ordinary conditions of growth and development. It is very evident that the two species have then several characteristics in common which are not evident when the cane is compared with corn in what we call its natural condition. The following have especial significance, as they approach maturity.

1. In both plants the solid stalk or culm has then become simply a reservoir of materials available for plant food, and in the case of the sugar cane, made use of when active growth by the joints begins.

2. In both, the development of the organized products is progressive, *i. e.*, from the more simple to the more complex of the series, which take the soluble form and are available for transmission to any points where new organized structure is to be built up.

3. By reason of the constant accumulation of these soluble materials, chiefly, the weight of the plant and the density of the juice increase.

4. The general plan of structure and physiological properties of the stem in both are very much alike, although there are very striking differences, and they become more alike, both in structure and function, as this period advances, the separate joints of the one and the whole stalk of the other attaining their full size before the highest elaboration of their juices takes place.

5. It is a well-attested fact that ordinarily no variety of sugar cane is known to perfect its seed or, to use the language of May, "to produce anything like seed, either in India, China, the Straits of Malacca, Egypt or the South Sea Islands." By a curious analogy maize, in this secondary stage of development, is likewise incapable of producing seed, having lost, apparently, its capacity in that direction.

There are other points of resemblance which it would be interesting to note, but that to which the most importance attaches in this connection is the highly saccharine condition of the juice in both, which ranks them together more closely than their striking natural relationship otherwise would seem to justify.

The reader is referred to the table in which the average sugar percentage of both is given as based upon the most recent and reliable analysis. It will be seen, I think, that the term *corn cane* has not unreasonably been applied to a plant which in a summer's growth can thus be made to develop qualities which give it a rank second only to the tropical cane.

Also, it will be observed that the saccharine qualities of the juice, only, have been compared in the table.

But, as between the other sugar-producing plants named and Indian corn there can be no further comparison. Maize is a cereal of the highest value, and it does not lose that character in this case. The high *condition of sugar development which it can now be made to attain is not attended by the sacrifice of the grain*, and against this grain product neither the sugar cane nor the beet can show any compensating value whatever.

This fact cannot be discounted by the assumed inferi-

\*Continued from Science, Sept. 15.